EUR 5100 e
Revised version 1974

COMMISSION OF THE EUROPEAN COMMUNITIES

CAMAC

A MODULAR INSTRUMENTATION SYSTEM FOR DATA HANDLING

Specification of Amplitude Analogue Signals within a 50 Ω System

1974

Joint Research Centre
ESONE Committee

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L u x e m b o u r g
December 1974

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ABSTRACT

The EURATOM Report EUR 4100 defines the essential features of the CAMAC system of instrumentation. This system is primarily for online use with digital controllers or computers. This document specifies single-ended unipolar and bipolar amplitude analogue signals which are recommended for CAMAC compatible units as used in a 50 Ohm transmission system. It includes and extends the specifications of the previous version, EUR 5100 (1972), and has been worked out in close cooperation with the U.S.AEC NIM Committee Analog Signals Working Group. Except for page 1, this report is identical to U.S.AEC Report TID-26614.

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1. INTRODUCTION

The EURATOM Report EUR 4100, (U.S.AEC Report TID-25875) defines the essential features of the CAMAC system of instrumentation. This system is primarily for on-line use with digital controllers or computers.

Representatives of European Research Laboratories under the auspices of the ESONE Committee and of the U.S. AEC NIM Committee have agreed to recommend standard analogue signals for use with the CAMAC system.

This specification is published to ensure compatibility between CAMAC units which process analogue signals. These analogue signals are input or output through connectors on the front panel or at the back of CAMAC compatible units above the Dataway.

An amplitude analogue signal is one whose amplitude conveys significant information. This specification applies both to continuous and to pulse-like electrical signals within a 50 Ω system. In the latter case, the amplitude may be significant during a portion of the wave-form (e.g., as for peak pulse amplitude analysis) or throughout the duration of the wave-form (e.g., as for pulse shape analysis).

Two unipolar signal classes are specified:

Class 5 PB for t_r > 30 ns, f_c < 11 MHz *)

Class 1 NB for t_r > 1 ns, f_c < 340 MHz

Two bipolar signal classes are specified:

Class 5NPB for t_r > 30 ns, f_c < 11 MHz *)

Class 1NPB for t_r > 1 ns, f_c < 340 MHz

These signals must satisfy the mandatory statements appropriate to their class.

Note: This specification applies to single-ended unipolar and bipolar signals as used in a 50 Ohm system and should not be interpreted as the only method required for CAMAC compatibility. Further specifications are being considered to cover standards applicable in e.g. industrial measurement and control (current mode signals, differential signals, and other voltage analogue amplitude signals, e.g. 10 V).

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*)

The designation of the classes is similar to IEC Publication 323. The code describes voltage, polarity, output impedance (B: 50 Ω).

A practical relationship between the upper 3 db cutoff frequency (f_c) and rise time (t_r) of a pulse-like signal, defined as the time interval between the 10 and 90 percentile points, is approximately given by $t_r \cdot f_c \approx 0.34$.

2. INTERPRETATION OF THIS DOCUMENT

This document is the reference text describing and specifying single-ended amplitude analogue signals for use between units which conform to the CAMAC specification EUR 4100 (1972).

Statements which specify mandatory aspects of the standard are written in bold type and blocked in, as here, and are usually accompanied by the word "must".

The word "should" indicates a recommended or preferred practice which is to be followed unless there are sound reasons to the contrary.

The word "may" indicates good practice but leaves freedom of choice to the designer.

In order to claim compatibility with this specification a signal must comply with the mandatory statements in this document.

There may be other analogue signal inputs and outputs to suit specific equipment with which the unit is closely associated. These are not considered to be necessarily compatible with this specification.

3. SPECIFICATION OF AMPLITUDE ANALOGUE SIGNALS

Amplitude analogue signals with rise times longer than 30 ns must be one of the Classes 5NPB, 5PB, 1NB, or 1NPB in accordance with Table 1. *Amplitude analogue signals with rise times between 1 ns and 30 ns must be either Class 1NB or 1NPB in accordance with Table 1.*

Amplitude analogue signals with rise times shorter than 1 ns should be either Class 1NB or 1NPB in accordance with Table 1, where technically feasible.

3.1 Output Characteristics

3.1.1 Output Voltage Range and Polarity

Class 5PB :	*The working range of an output EMF must be 0 V to + 5 V.*

Class 5NPB: *The working range of an output EMF must be − 5 V to + 5 V.*

Class 1NB: *The working range of an output voltage across a 50 Ω load must be 0 V to − 1 V.*

Class 1NPB: *The working range of an output voltage across a 50 Ω load must be − 1 V to + 1 V.*

The following applies for bipolar signals where only one polarity conveys the significant amplitude information:

Class 5NPB: *the significant polarity must be positive.*

Class 1NPB: *the significant polarity must be negative.*

3.1.2 Maximum Output Voltage

Class 5PB :
Class 5NPB: *The absolute maximum range of an output EMF must be − 7.5 V to + 7.5 V.*

Class 1NB :
Class 1NPB: *The absolute maximum range of an output voltage must be − 3 V to + 3 V.*

3.1.3 Output Current Range

Class 5PB :
Class 5NPB: *The output must be able to provide 5 mA.*

The output should be able to provide 50 mA. This is essential when driving a matched input.

Class 1NB :
Class 1NPB: *The output must be able to provide 20 mA.*

3.1.4 Output Impedance

Class 5PB : Class 5NPB:	*The output impedance must be 50 Ω ± 5 %.*

Class 1NB : Class 1NPB:	The output impedance should be 50 Ω ± 10 %. The output impedance of a current or a voltage source may also be used.

3.1.5 Output Protection

An output must be able to withstand connection to 0 V without damage under all working conditions for all classes.

3.2 Input Characteristics

3.2.1 Input Impedance

Class 5PB : Class 5NPB:	*An unmatched input must have a high impedance of which the resistive component is greater than 5000 Ω.* *If a signal path is matched at the receiving end, the termination must be 50 Ω ± 5 %.*

Class 1NB : Class 1NPB:	*The terminating impedance at the receiving end must be 50 Ω with a tolerance of ± 5 % for* $t_r \geq 3$ *ns.* *The tolerance must not exceed ± 10 % for* $3\ ns > t_r \geq 1\ ns$.

Feedthrough (bridging) inputs with external matching termination may be used. The impedance of such an input, terminated with 50 Ω ± 1 %, should meet the input impedance specification of its class. The resistive component should be greater than 5000 Ω.

3.2.2 Input Voltage Range and Polarity

The working range of the input voltage must be consistent with the output voltage range and polarity specification of 3.1.1.

Provision should also be made to accept signals of opposite polarity.

3.2.3 Input Protection

An unmatched input must withstand any voltage in the range - 15 V to + 15 V. *A matched input must withstand any voltage in the range - 4 V to + 4 V.*

4. CONNECTORS

4.1 Coaxial Connector

Coaxial connectors must have an impedance of 50 Ω and must be in accordance with ESONE Drawing CD 549 or the equivalent NIM Drawing ND 549.

The signal class and internal impedance associated with each connector should be indicated.

TABLE 1

AMPLITUDE ANALOGUE SIGNALS

Characteristics	Class	Output	Input Matched	Input Unmatched
Working Voltage Range	5PB 5NPB	0 V to + 5 V -5 V to + 5 V	0 V to + 2.5 V -2.5 V to + 2.5 V	0 V to + 5 V -5 V to + 5 V
	1NB 1NPB	0 V to - 1 V across a 50 Ω load -1 V to + 1 V across a 50 Ω load	0 V to - 1 V -1 V to + 1 V	- -
Impedance	5PB 5NPB	50 Ω ± 5 %	50 Ω ± 5 %	> 5000 Ω
	1NB 1NPB	50 Ω ±10 % +	50 Ω ± 5 % Δ	> 5000 Ω *
Absolute Maximum Voltage Range	5PB 5NPB	-7.5V to +7.5V	-4 V to + 4 V	-15V to +15 V
	1NB 1NPB	- 3 V to + 3 V	-4 V to + 4 V	-15V to +15 V *

\+ The output impedance of a current or voltage source may also be used.

* For feedthrough (bridging) inputs only.

Δ 50 Ω ± 10 % for 1 ns $\leq t_r < 3$ ns

APPENDIX 1

The ESONE Committee

The Committee comprises representatives from laboratories, institutes and organisations which have an interest in the compatibility of electronic equipment.

The Committee has a permanent Secretariat. When the Committee is not in session its business is handled by an Executive Group consisting of the secretary and one representative from each of C.E.R.N., Euratom, C.E.A. France, U.K. Nuclear Laboratories, Deutsche Studiengruppe für Nukleare Elektronik, and C.N.E.N. Italy. These representatives are nominated by their respective organisations. The Chairman of the Executive Group is also the Chairman of the ESONE Committee and is chosen annually from the nominated representatives.

A list of member laboratories is given in this Appendix. Further information about current membership and nominated representatives on the Committee and Executive Group can be obtained from the Secretary.*

This document is approved by the ESONE Committee and authorized for publication by the Executive Group. Any questions relating to the interpretation of this document should be submitted to the Secretary. Any points that cannot be cleared by him will be referred to the Executive Group for resolution.

Users of this document who wish to be informed of any future revisions should inform the Secretary.

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Telephone: Belgium 32, Geel 14, 589421
Telex-Number: 33589 EURATOM B

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APPENDIX 2

The NIM Committee

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Institutions having representatives on the NIM Committee are:

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Participating laboratories also include:

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Alfred Nobel

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